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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36362

STEBG-TD

30 JUN 1965

SUBJECT: ~~Report of Test~~ Re-Test of Modified OMNI and ADF Equip-
ments, USATECOM Project Numbers 4-4-4315-01 and
4-4-4316-01

TO: Commanding General
US Army Electronics Command
ATTN: AMSEL-AV-G
Fort Monmouth, New Jersey 07703

16 USATECOM-4-4-4315-01,
USATECOM-4-4-4316-01

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1. References. See inclosure 1 for list of references

2. Authority. Message APG 6929, Headquarters, US Army Test and Evaluation Command, 28 April 1965, subject: "Re-Test of Modified OMNI and ADF Equipments."

3. Background.

a. During the period 1 October 1964 through 15 December 1964, three different manufacturers' OMNI receiver and Automatic Direction Finder (ADF) systems were tested by the US Army Aviation Test Board (USAAVTBD), US Army Electronics Proving Ground (USAEPG), and US Army Human Engineering Laboratory (USAHEL). The final report was submitted on 4 February 1965.

b. As a result of this testing, it was determined that there were deficiencies that must be corrected prior to acceptance of any system. Because of the requirement for a competitive procurement, US Army Electronics Command (USAECON) negotiated with each manufacturer and explained his individual equipment deficiencies. The manufacturers agreed to correct these deficiencies and to resubmit their equipments for test. On 31 March 1965, USAECON requested that USATECOM

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retest the Aqua and Maroon OMNI systems and the Maroon ADF system, all of which had been modified. On 15 April 1965, Headquarters, USATECOM, directed the USAAVNTBD to conduct the retest.

c. The test items were installed on RU-8D Airplane. Ground checks and equipment calibration were accomplished by the respective manufacturers' representatives. The Maroon manufacturer released Maroon equipment for flight testing on 4 May 1965. The Aqua manufacturer released Aqua equipment for flight testing on 17 May 1965.

d. Prior to release of the test equipment, the Aqua manufacturer installed his modified OMNI equipment in a company airplane and tested the equipment on the airways used in the original evaluation conducted by the USAAVNTBD. During these tests, the Aqua equipment did not operate satisfactorily at the published minimum reception altitude (MRA) on airway V-241 over the Abbeville intersection. The manufacturer also determined, to his satisfaction, that the reason for the unsatisfactory operation of his equipment was that there was insufficient signal strength present at the published MRA over Abbeville.

e. The USAAVNTBD requested that the Federal Aviation Agency (FAA) perform a flight inspection of the airway in question. The FAA performed this flight inspection during the period 5 May 1965 to 7 May 1965. The FAA representative reported to the USAAVNTBD that the airway was checked and that there was sufficient signal strength at the published MRA at Abbeville intersection.

f. The Aqua manufacturer contacted the FAA in Atlanta, Georgia, and arranged to have the airway flight inspected using Aqua equipment. During this flight inspection, the FAA, in conjunction with the Aqua manufacturer, determined that the antenna used by the FAA for all their flight inspections had a higher gain than the Army standard antenna.

g. As a result of this FAA-Aqua flight inspection, the USAAVNTBD has been notified that a report is being forwarded through channels to raise the minimum reception altitude (MRA) at Abbeville intersection from 2,000 feet to 2,500 feet.

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4. Test Objectives.

a. OMNI. To determine MRA capabilities of the modified Aqua and Maroon OMNI equipments.

b. ADF. To determine the performance of the modified Maroon ADF equipment when operating in flight.

5. Method.

a. OMNI. The modified OMNI equipments were installed in RU-8D type aircraft. The aircraft were flown on the selected airways used in the original test at the MRA specified by the Federal Aviation Agency.

b. ADF. The modified ADF equipment was installed in an RU-8D type airplane. The airplane was flown over selected ground tracks (used in the original test) to and from low-frequency (LF) ground stations. Performance-in-flight data were recorded using the original test plan (reference 19, inclosure 1) as a guide.

6. Results.

a. OMNI.

(1) The modified Aqua and Maroon OMNI equipments did not operate satisfactorily at MRA on airway V-241 at Abbeville intersection; however, the FAA has agreed that the MRA at this intersection must be changed because of insufficient signal strength at the published altitude (see inclosure 2).

(2) The modified Aqua OMNI equipment operated satisfactorily at MRA on all other airways flown.

(3) The modified Maroon OMNI equipment operated intermittently at MRA on airway V-56 at Mitchell intersection; however, the MRA at this intersection is also questionable because of its similarity to the Abbeville intersection. The Maroon equipment operated satisfactorily at MRA on all other airways flown.

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b. ADF.

(1) The modified Maroon ADF equipment had an average maximum usable range of 51 nautical miles. The clarity of the received signal of the modified equipment was improved over the unmodified equipment previously tested. However, loss of the station identifier in normal background noise was the limiting range factor in all cases. An increase in the stability and accuracy of the indicator needle permitted better track following, homing, ADF orientation, and ADF approaches.

(2) A high-amplitude, high-frequency pulse (tone) of short duration occurred in the headsets when the ADF was turned on or off. The loud tone pulse was objectionable but did not interfere with normal operation. The cause of the tone pulse was not determined because of the short test period.

7. Conclusions.

a. The modified Aqua and Maroon OMNI equipment operated satisfactorily at MRA on all the test airways except those found questionable by the FAA and the USAAVNTBD.

b. The modified Maroon ADF equipment operated satisfactorily during flight.

8. Recommendations. It is recommended that:

a. The MRA performance of the Aqua and Maroon equipment be considered adequate.

b. The modified Maroon ADF equipment be considered adequate from a flight performance standpoint.

c. The relative standings established in the original reports of the OMNI and ADF equipments not be changed as a result of this limited retesting.

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d. The OMNI and ADF systems selected be subjected to a complete engineering/service test prior to acceptance by the US Army as a standard item.



RAYMOND E. JOHNSON
Colonel, Artillery
President

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Copies furnished:

2 CG, USATECOM
ATTN: AMSTE-BG
Aberdeen Proving Ground, Md. 21005

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1. Report of Test, Project No. AVN 6356, "Comparative Evaluation of Automatic Direction Finding Equipment," US Army Aviation Board, April 1957.
2. Technical Manual TM 11-5826-204-35, Department of the Army, 12 September 1958.
3. Technical Manual TM 11-5826-207-10, Department of the Army, June 1959.
4. Technical Manual TM 11-5826-207-50, Department of the Army, June 1959.
5. Paper 158-61/DO-111, "Minimum Performance Standards Airborne Radio Receiving and Direction Finding Equipment Operating within the Frequency Range of 200-415 Kilocycles," Radio Technical Commission for Aeronautics, 10 August 1961.
6. Technical Manual TM 11-5826-215-12, Department of the Army, 21 August 1961.
7. Technical Manual TM 11-5826-215-35, Department of the Army, 21 August 1961.
8. ARINC Characteristic No. 550, "Airborne ADF System Mark-2," Aeronautical Radio, Inc., 1 March 1962.
9. Technical Manual TM 11-2557-25, Department of the Army, Third Edition, May 1963.
10. Technical Manual TM 11-5826-204-12, Department of the Army, 30 September 1963.
11. Letter, Assistant Secretary of the Army (ASA), Installation and Logistics (Mr. Ignatius), 13 November 1963, subject: "FY 64 Procurement of Avionics Equipment," with four indorsements thereto.
12. Letter, AMSEL-AV-E, Headquarters, US Army Electronics Command, 24 February 1964, subject: "Modernization Program for OMNI-Range Receivers, Automatic Direction Finding Equipment and Lightweight HF Aircraft Radio Sets," with one inclosure.

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13. Memorandum for Record, STEBG-TPAV, US Army Aviation Test Board, 15 April 1964, subject: "Test Requirements Conference, Military Potential (Comparative Evaluation) Test of the OMNI, ADF, and HF Radios, USATECOM Project No. 4-4-4315/4316/4317."

14. Memorandum for Record, STEBG-TPAV, US Army Aviation Test Board, 15 April 1964, subject: "Test Requirements Conference, Military Potential (Comparative Evaluation) Test of the OMNI, ADF, and HF Radios, USATECOM Project No's. 4-4-4315/4316/4317."

15. Memorandum for Record, STEBG-TPAV, US Army Aviation Test Board, 29 April 1964, subject: "USAECOM/USATECOM Planning Conference for Military Potential Test of OMNI, ADF, and HF Radios, USATECOM Project No's. 4-4-4315/4316/4317."

16. Message, AMSEL-RD-SRI-5-27, US Army Electronics Command, 6 May 1964, subject: "Confirming Telephone Message to Major Treece on 1 May 1964 Regarding Military Potential Test of OMNI and ADF Receivers."

17. Letter, SELMA-M5e-4, US Army Electronics Command, 16 May 1964, subject: "Solicitation No. AMC(E)26-039-64-430-8 (Step I) (Invitation for Bid) (IFB)."

18. Plan of Test, USATECOM Project No. 4-4-4315-(), "Military Potential Test (Comparative Evaluation) of OMNI-Range Receiver Sets," US Army Aviation Test Board, 15 June 1964, as revised.

19. Plan of Test, USATECOM Project No. 4-4-4316-01, "Military Potential Test (Comparative Evaluation) of Automatic Direction Finding Equipment," US Army Aviation Test Board, 15 June 1964.

20. Message, STEBG-PR, US Army Aviation Test Board, 19 June 1964, subject: "Comparative Evaluation OMNI and ADF Navigation Equipments."

21. Minutes of Conference held at USAECOM, Fort Monmouth, New Jersey, 1-2 July 1964, subject: "Evaluation of Commercial Equipment to Replace the AN/ARN-30 OMNI and AN/ARN-59 ADF Radio Sets."

22. Signal Corps Letter (SCL) 8012B, "Direction Finder, Automatic Lightweight, Airborne," US Army Electronics Command, 10 July 1964, with Amendment No. 1, 7 August 1964.

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23. Signal Corps Letter (SCL) 8014, "Receiver Set, Radio, Units of (Replacement of AN/ARN-30()), " US Army Electronics Command, 7 February 1964, with Amendment No. 2, 12 August 1964.

24. Interim Report, USATECOM Project No. 4-4-4315-(), "Military Potential Test (Comparative Evaluation) of OMNI-Range Receiver Sets," US Army Aviation Test Board, 16 December 1964.

25. Report of Test, USATECOM Project No. 4-4-4316-01, "Military Potential Test (Comparative Evaluation) of Automatic Direction Finding Equipment," US Army Aviation Test Board, 4 February 1965.

26. Report of Test, USATECOM Project No. 4-4-4315-01, "Military Potential Test (Comparative Evaluation) of OMNI-Range Receiver Sets," US Army Aviation Test Board, 4 February 1965.

27. Paper 120-61/DO-108, "Environment Test Procedures, Airborne Electronic Equipment," Radio Technical Commission for Aeronautics.

28. Federal Aviation Agency (FAA) Technical Standard Order (TSO) C-36a.

29. Federal Aviation Agency Technical Standard Order C-38a.

30. Federal Aviation Agency Technical Standard Order C-40a.

31. Federal Aviation Agency Technical Standard Order C-41.

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UNITED STATES GOVERNMENT
MEMORANDUM

FEDERAL AVIATION
AGENCY

DATE: May 12, 1965

SUBJECT: VOR reception utilizing the Collins 37J and the ARC-AS-580 A/ARN 30 antennas.

FROM: Supervisory Facilities Flight Check Pilot, SO-FIDO-ATL

TO: Chief, Flight Inspection Branch, SO-130

A special flight inspection was conducted on 5-12-65 in association with Bendix Radio Corporation to determine the working characteristics of the RA 21 VOR Receiver utilizing a Collins 37J and an ARC-AS-580A/ARN 30 VOR Antenna. Also, a comparative check of the flight inspection MN 85 FA VOR Receiver utilizing each of the antennas was made.

This inspection was made in the area of Eufaula, Alabama, utilizing Albany, Georgia VOR to make up the intersections that had been questioned by the U. S. Army Flight Detachment at Fort Rucker, Alabama. These intersections, Baker Hill and Abbeville, were found unreliable and/or unusable utilizing the Bendix RA 21 Receiver with the ARC-AS-580A/ARN 30 Antenna and with the flight inspection MN 85 FA Receiver utilizing the ARC-AS-580A/ARN 30 Antenna. The RA 21 and the MN 85 FA receivers appeared to give approximately the same results when the receiver/antenna combination were the same. The ARC-AS-580A/ARN 30 Antenna was less sensitive than our 37J Antenna, and in weak signal areas of 5 to 10 microvolts, the ARC-AS-580A/ARN 30 Antenna showed 1 to 4 microvolts and a loss of flag current, which rendered the intersections unusable. The final analysis was that the two receivers compared favorably, but the ARC-AS-580A/ARN Antenna was much less sensitive than our 37J Antenna. There was also a definite difference in sensitivity between the right and left side of the ARC-AS-580A/ARN 30 Antenna.

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SUBJECT: VOR reception utilizing the Collins 37J and the ARC-AS-580A/ARN 30 antennas.

With the normal flight inspection configuration of receiver/antenna combination, Baker Hill Intersection worked well at 2000' MSL, but Abbeville appeared unreliable at this altitude. A request is in progress at this time to have the altitude at Abbeville changed to 2500' MSL and Baker Hill changed to 2000' MSL on the enroute low altitude charts.

/s/ M. E. Skipper

/t/ M. E. SKIPPER

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